

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

Applicant: Dr. Frederik Bijkerk, et al.

Examiner:

Serial No.:

Group Art Unit:

Filed: November 12, 2003

Date: November 12, 2003

For: "MULTILAYER SYSTEM WITH PROTECTING LAYER SYSTEM AND
PRODUCTION METHOD"

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT

Sir:

This invention relates to a multilayer system and its production. Multilayer systems, such as those used as mirrors in the extreme ultraviolet wavelength range, suffer contamination or oxidation during storage in air and in long-time operation, i.e. when exposed to EUV radiation in a vacuum environment with certain partial pressures of water or oxygen, which causes a serious reduction in reflectivity. The multilayer system according to the invention will have a long life with constantly high reflectivity. Their reflectivity can be enhanced by barrier layers. The multilayer systems according to the invention have protective layers comprising iridium. The multilayer systems according to the invention are produced by direct, ion-beam-supported growth of the respective layer. The multilayer systems according to the invention are not only resistant to contamination and oxidation, but can also be cleaned, if necessary, without losing reflectivity. Because of their long life with

constantly high reflectivity, they are particularly suitable for use in semiconductor lithography in the soft X-ray range or extreme ultraviolet wavelength range.

As authorized and encouraged under 37 C.F.R. §1.97-1.99, Applicant hereby cites as a means of complying with the duty of disclosure set forth in 37 C.F.R. §1.56, the following patents and/or documents, copies enclosed, which the Examiner should consider with respect to the above-identified United States Patent Application:

U.S. DOCUMENTS		
PATENT/DOCUMENT NO.	DATE	INVENTOR
5,052,033	September 1991	Ikeda et al.
5,265,143	November 1993	Early et al.
5,433,988	July 18, 1995	Fukuda et al.
5,760,981	June 2, 1998	Gillich
5,958,605	September 1999	Montcalm et al.
5,310,603	May 10, 1994	Fukuda et al.
6,160,867	December 2000	Murakami
FOREIGN DOCUMENTS		
PATENT/DOCUMENT NO.	DATE	COUNTRY
WO 99/24851	May 20, 1999	WIPO
08122496	May 17, 1996	JP
06273596	September 30, 1994	JP
1 065 568 A2	January 3, 2001	EP
ARTICLES		
J.H. Underwood et al., <i>Tarnishing of Mo/Si multilayer x-ray mirrors</i> , Applied Optics, vol. 32, 1993, p. 6985-6990		
C. Montcalm et al., <i>Multilayer reflective coatings for extreme-ultraviolet lithography</i> , SPIE, vol. 3331, (1998) p. 42-51		
M. Cilia et al., <i>Ni/Si based multilayer for the reflection of soft x rays in the "water window"</i> , J. Appl-Phys., 82 (9), 1997, p. 4137-4142		
H. Takenaka et al, <i>Design and fabrication of highly heat-resistant Mo/Si multilayer soft X-ray mirrors with interleaved barrier layers</i> , J. Synchrotron Rad. (1998) 5. p. 708-710		
E.J. Puik et al., <i>Ion bombardment of X-ray multilayer coatings: comparison of ion etching and ion assisted deposition</i> , Applied Surface Science 47 (1991) p 251-260		

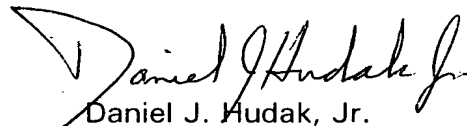
Copies of the publications are included for the express purpose of providing the Patent and Trademark Office with an ample opportunity to evaluate the same and to arrive at an independent assessment of their materiality, if any, with regard to the examination of the application.

In reviewing the enclosed copies of the above publications, the Examiner is requested to ignore any underscoring or highlighting which may appear because such markings may or may not have any relationship to the subject matter of the above-identified application. The copies being submitted with this Information Disclosure Statement are the best copies available at this time.

An examination of the present application considering the above documents is requested.

Respectfully submitted,

HUDAK, SHUNK & FARINE CO. LPA

A handwritten signature in black ink, appearing to read "Daniel J. Hudak, Jr.", is written over the printed name.

Daniel J. Hudak, Jr.
Registration No. 47,669

DJHjr/lb

7 West Bowery Street, Suite 808
Akron, OH 44308-1133
Telephone: (330) 535-2220

Attorney Docket No.: FMW-GG-CIP

(CZ 22-CIP)

Form PTO-1449 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use several sheets if necessary)				Atty. Docket No.: FMW-GG-CIP (CZ 22-CIP)		Serial No.:	
				Applicant: Dr. Frederik Bijkerk et al.			
				Filing Date: November 12, 2003		Group:	

U.S. PATENT DOCUMENTS							
Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing date if appropriate
	AA	5,052,033	September 1991	Ikeda et al.			
	AB	5,265,143	November 1993	Early et al.			
	AC	5,433,988	July 18, 1995	Fukuda et al.			
	AD	5,760,981	June 2, 1998	Gillich			
	AE	5,958,605	September 1999	Montcalm et al.			
	AF	5,310,603	May 10, 1994	Fukuda et al.			
	AG	6,160,867	December 2000	Murakami			
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS							
		Document Number	Date	Country	Class	Subclass	Translation Yes No
	AL	WO 99/24851	May 20, 1999	WIPO			
	AM	08122496	May 17, 1996	JP			
	AN	06273596	September 30, 1994	JP			
	AO	1 065 568 A2	January 3, 2001	EP			
	AP						

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)			
	AR		J.H. Underwood et al., <i>Tarnishing of Mo/Si multilayer x-ray mirrors</i> , Applied Optics, vol. 32, 1993, p. 6985-6990
	AS		C. Montcalm et al., <i>Multilayer reflective coatings for extreme-ultraviolet lithography</i> , SPIE, vol. 3331, (1998) p. 42-51
	AT		M. Cilia et al., <i>Ni/Si based multilayer for the reflection of soft x rays in the "water window"</i> , J. Appl-Phys., 82 (9), 1997, p. 4137-4142

EXAMINER	DATE CONSIDERED
----------	-----------------

***EXAMINER:** Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Form PTO-1449 U.S. Department of Commerce Patent and Trademark Office LIST OF PRIOR ART CITED BY APPLICANT (Use several sheets if necessary)				Atty. Docket No.: FMW-GG-CIP (CZ 22-CIP)		Serial No.:	
				Applicant: Dr. Frederik Bijkerk et al.			
				Filing Date: November 12, 2003			
U.S. PATENT DOCUMENTS							
Examiner Initial		Document Number	Date	Name	Class	Subclass	Filing date if appropriate
	AA						
	AB						
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						
FOREIGN PATENT DOCUMENTS							
		Document Number	Date	Country	Class	Subclass	Translation Yes No
	AL						
	AM						
	AN						
	AO						
	AP						
OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)							
	AR		H. Takenaka et al, <i>Design and fabrication of highly heat-resistant Mo/Si multilayer soft X-ray mirrors with interleaved barrier layers</i> , J. Synchrotron Rad. (1998) 5. p. 708-710				
	AS		E.J. Puik et al., <i>Ion bombardment of X-ray multilayer coatings: comparison of ion etching and ion assisted deposition</i> , Applied Surface Science 47 (1991) p. 251-260				
	AT						
EXAMINER				DATE CONSIDERED			
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.							